

Forest – Forest Management, Forest Damages, Afforestation

Deforestation and (re-)afforestation always have been the two extremes in the life cycles of forests. Natural changes e.g. by events such as wildfires or storm damage have been followed by re-growth of young trees, leading to an overall stable status of the forested areas, which has undergone only slow modifications as a consequence of long-term climate change. With the advent of man a different development has started: the changes occur on a larger scale and in most cases are not returning to the original equilibrium state. The examples presented show different types of forest changes – from more or less sustainable forest management, windthrow changes and environmental damage to commercial afforestation and the use of forests as shelter from desertification and erosion.

Map Descriptions

Map 1a: Forest near Salzburg, Austria

Satellite/Sensor: IKONOS
Acquisition Date: 19.09.2000
Band Combination: false colour infrared
Map Information: -

Map 1b: Forest management units, Austria

Satellite/Sensor: based on IKONOS
Acquisition Date: 19.09.2000
Band Combination: pseudo colours
Map Information: forest management units, proportion of broadleaved trees.

Description: The two maps show a small part of a forest section near Salzburg, Austria. The false colour infrared satellite image clearly shows differences in the forest stands, with respect to both the species composition and the age classes. Broadleaved trees appear in a reddish tone whereas coniferous trees appear dark green. Similarly, younger trees show a lighter colour, whereas the stands with older trees are both darker and more structured due to the shadows thrown by the larger trees. The thematic map (Map 1b) has been derived from the infrared satellite image, also using the stand boundaries of the forest owners, and shows the proportion of broadleaved forest and the different forest utilisations. Satellite data are a valuable instrument for the assessment of the status of forests and are therefore widely used as a forest management tool.

Map 2: Windthrow patterns, spruce forest

Satellite/Sensor: Ground Photograph
Acquisition Date: March 2004
Band Combination: -
Map Information: -

Description: The photograph shows the typical result of storm damage in a spruce forest. A flank of the forest has been exposed to the storm by felling, leading to a reduction of its stability. Once the storm has thrown a first line of trees, the next line is exposed to its forces and so on. The image gives an impression of the extent of the damage and of the problems involved in accessing affected areas.

Map 3a: Windthrow, Salzach valley, Austria

Satellite/Sensor: SPOT XI
Acquisition Date: 19.01.2003
Band Combination: false colour infrared
Map Information: -

Description: The false colour infrared satellite image map shows a winter view of the upper Salzach valley, Austria, two months after a catastrophic foehn storm that led to a windthrow event, which destroyed more than 60 km² of the forest in the province of Salzburg. The satellite image map shows areas covered by snow, forests (red) and windthrow areas (lighter red). This is a result of the fact that forested areas are snow-free earlier than fields. Windthrow areas are a mixture of these two main land cover classes. As a consequence, this type of winter data can be used to identify the windthrow areas. Note also the illumination differences between the north and south oriented slopes due to the low sun angle.

Map 3b: Suspected windthrow areas

Satellite/Sensor: Landsat TM/SPOT Pan
Acquisition Date: mosaic, 2001
Band Combination: near natural colours
Map Information: suspected windthrow areas

Description: The map shows the suspected windthrow areas derived from the satellite data (Map 3a) overlaid onto a satellite image acquired in a summer before the windthrow. The map gives an impression of the extent of the area affected by the storm.

Map 4: Windthrow areas, detail

Satellite/Sensor: SPOT XI/SPOT PAN
Acquisition Date: 19.01.2003
Band Combination: false colour infrared
Map Information: -

Description: This detail view shows a section of Map 3a with windthrow areas. The areas in the valley along the eastern margin of the map remained untouched, whereas the more exposed forests on the slope oriented southwards are heavily damaged. The map also shows the lines of the forestry roads roughly following the elevation contours.

Map 5a: Forest status 1975, Ore Mountains, Czech Rep./Germany

Satellite/Sensor: Landsat MSS
Acquisition Date: 29.04.1975
Band Combination: near natural colours
Map Information: -

Map 5b: Forest status 1984, Ore Mountains, Czech Rep./Germany

Satellite/Sensor: Landsat TM
Acquisition Date: 30.10.1984
Band Combination: near natural colours
Map Information: -

Map 5c: Forest status 2005, Ore Mountains, Czech Republic/Germany

Satellite/Sensor: Landsat ETM
Acquisition Date: 29.08.2005
Band Combination: near natural colours
Map Information: -

Description: Regional-scale air pollution has been identified as an important contributing factor in forest deterioration. The images give an overview of the Ore Mountains (Erzgebirge) that form the border between Germany and the Czech Republic, and parts of the industrialised Bohemian Basin. The Ore Mountains (Krušné hory), oriented from south-west to north-east, rise steeply above the Most Basin on their Czech side and descend gradually on their German side. Due to their morphology they form a wind barrier and a specific microclimate situation over the basin, creating unfavourable conditions for the dispersion of clouds.

A brown coal belt with numerous power stations fuelled by lignite (brown coal) is located along the basin. These industrial activities have generated the emission of increasingly high levels of sulphur dioxide (SO₂) and nitrogen dioxide (NO₂), thus contaminating the air with excessive concentrations of pollutants trapped over the basin during long periods. Satellite based estimations of coniferous forest cover change in Ore Mountains indicate that 50% of the forest disappeared between the 1970ies and 1990ies. The most affected areas are the south and south-east facing slopes between 600 and 1000 m above sea level. The affected areas are displayed in Maps 5a and 5b by a brownish colour. Since modern technologies and emission reduction measures have been introduced, forest health has improved due to significant declines of air pollution by SO₂. The improvement can be clearly recognised in Map 5c. It is the result of lower aerosol concentration in the atmosphere by comparison with the older images.

Map 6a: Forest status 1979, Angol, Chile

Satellite/Sensor: Landsat MSS
Acquisition Date: 19.03.1979
Band Combination: near natural colours
Map Information: -

Map 6b: Forest status 1986, Angol, Chile

Satellite/Sensor: Landsat TM
Acquisition Date: 30.12.1986
Band Combination: near natural colours
Map Information: -

Map 6c: Forest status 2000, Angol, Chile

Satellite/Sensor: Landsat ETM
Acquisition Date: 27.01.2000
Band Combination: near natural colours
Map Information: -

Description: Maps 6a to 6c show reforestation efforts around Angol, Chile. The trees are mainly planted for commercial use (paper and timber production). Based on remote sensing data, the rapid change of forested areas can be documented. Afforestation takes place on agricultural areas in the eastern part of the image. The change of forest cover during the period from 1979 to 2000 on the western mountain ridges is obvious. In order to gain profits, fast-growing, non-endemic tree species like pine and eucalyptus are planted. Typically, trees grown in plantations are harvested after 15 years. The even-aged monoculture enhances the degradation of the soils in the region by depletion of nutrients. This type of forest management has a negative effect on the natural ecosystem.

Map 7: Yulin, overview

Satellite/Sensor: Landsat ETM
Acquisition Date: 06.08.2002
Band Combination: near natural colours

Map Information: -

Description: The area around Yulin in the Chinese province Shaanxi is massively threatened by desertification. Desertification goes hand in hand with environmental deterioration and land degradation, which results in heavy economic losses. Yulin is located in a fragile transition zone from semi-arid to arid, desert-like conditions. The area lies in the southern edge of the Mu Us desert and is part of the north-eastern area of the loess plateau. Several measures have been taken to reduce or even stop the desertification process,. Sand dunes, which can be clearly seen in the northern part of Map 8, have been stabilised by planting of vegetation. A shelter network dominated by narrow forest grids in combination with shrubby grass plantations was established to form a farmland protection system.

As a result of the adoption of the aforementioned measures, the expanse of sandy desertified land was isolated and encircled by green ecological breaks and forest coverage increased.

Map 8: Yulin, detail forest grids

Satellite/Sensor: QuickBird
Acquisition Date: 23.10.2005
Band Combination: near natural colours
Map Information: -

Description: The satellite image map shows a detail from the north-eastern part of Map 7. The area lies at the edge of the dunes spreading towards the agricultural land in the south-east. The afforestation measures can be easily identified by the regular lines of trees following the shapes of the dunes on one hand, and by the compact forest areas on the slopes of the dunes. In between agricultural areas can be seen.

Map 9: Yulin, Detail Afforestation

Satellite/Sensor: QuickBird
Acquisition Date: 23.10.2005
Band Combination: near natural colours
Map Information: -

Description: The satellite image map shows a detail a few kilometres east of that in Map 8. Here, too, the forest grids protecting the agricultural land show up, they are oriented at 90° to the prevailing wind.

Map 10a: Forest status 1978, near Yulin, China

Satellite/Sensor: Landsat MSS
Acquisition Date: 19.08.1978
Band Combination: false colour infrared
Map Information: -

Map 10b: Forest status 1989, near Yulin, China

Satellite/Sensor: Landsat TM
Acquisition Date: 11.09.1989
Band Combination: false colour infrared
Map Information: -

Map 10c: Forest status 2002, near Yulin, China

Satellite/Sensor: Landsat ETM
Acquisition Date: 06.08.2002

Band Combination: false colour infrared

Map Information: -

Description: The three satellite images show the development of the region around the city of Yulin in the province of Shaanxi, China. Areas in light red are cultivated fields. Reforested areas are displayed in dark red to brown,. A comparison of Map 10c with 10a shows significant differences. By 2002 large areas of the map, mainly around the city of Yulin, are covered with forests and other means of protection. Similarly, the area used for agriculture and the physical extent of Yulin have increased.